ANALYSIS OF QUARTER MODEL OF MCPHERSON AND MODIFIED SUSPENSION SYSTEM

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ABSTRACT

Suspension system is essential part of the vehicle. Passenger cars commonly use front suspension as Macpherson suspension system to absorb road shocks and provide comfort to passengers. Even freshly paved roads are not smooth roads have irregularities and it cause bumpy ride if suspension system are not used. Most of the work carried out on the coil spring of the suspension system. For more comfort of the passengers modification of the existing suspension is necessary when irregularities are present in road. Here we have taken Mcpherson suspension system of existing car. We have done analysis with kerb weight of the car. After modifying design we are going to do analysis again with the kerb weight.

Keywords: ADAMS, Mcpherson suspension system, Modified suspension system

I INTRODUCTION

Suspension is the term given to the system of springs, shock absorbers and linkages that attach a vehicle to its wheels and allows relative motion between the two. Suspension systems serve a double purpose that is contributing to the vehicle's road holding/handling and braking for good active safety and driving pleasure, and keeping vehicle rider comfortable and reasonably well isolated from road noise, bumps, and vibrations, etc. Suspension system also allow smooth ride over irregularity of roads. Also it allows cornering without changing center of gravity and maintaining stability.

When a car rides over irregular roads then the springs are compressed, store the energy and provide shock absorption. The energy released from the spring as soon as it gets it original position. Dampers are employed to smooth and slow down the bounce motion, this is called "Damping". Without dampers, the car will bounce up and down severely and quickly, this is perceived as uncomfortable. The factors which primarily affect the choice of suspension type at the front or rear of the vehicle are the engine location and whether the front wheels are driven /undriven and /or steered/unsteered. Analysis of suspension system is done on the Automatic Dynamic Analysis of Mechanical System (ADAMS).

II. ADAMS AND ITS ANALYSIS PROCEDURE

An ADAMS is multi-body dynamic simulation software, for doing analysis in ADAMS first 3-d modelling is done in Pro-e and importing the model to ADAMS. For quarter model analysis of suspension system material and joints have to be applied to the imported parts and then wheel movements are given. The results are obtained in the form of time history plot for force and displacement of the spring. Simulation results are same as obtained by analytical procedure.

Some physical parameters in the equation of motion can be calculated directly while other parameters must be identified from experiments. One of these parameters is force exert on the spring while deflection for that analysis of the mechanism in ADAMS we have to follow some standard procedure.

Step to follow for the analysis is as shown in fig 1. The detailed procedure is as below. For analysis first we have to import 3d modeling file from Creo. Also we have to connect the parts with the proper joints given in ADAMS command toolkit. Next we have to apply the proper materials to the parts of suspension, where we have to apply deflection on the wheel and we can plot graphs by analyzing in dynamic condition. From the analysis in the dynamic condition we can get the deflection of the suspension system and force to time graphs from the ADAMS. Graphs for deflection or force can be plotted in the post processor after getting data from simulation in ADAMS with applied condition, where all the procedure applied to both existing and modified suspension system.

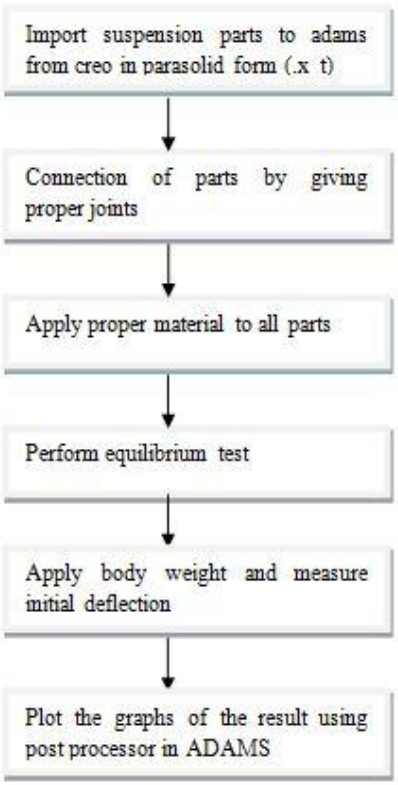

Fig 1 Steps for Analysis Procedure in ADAMS

III. ANALYSIS OF EXISTING AND MODIFIED SUSPENSION SYSTEM USING ADAMS

Here kerb weight is applied on the existing and modified suspension system and deflection due to kerb weight is measured. Analysis is carried out in ADAMS with the same condition given to both suspension systems.

3.1 Analysis Of Existing Suspension System In ADAMS

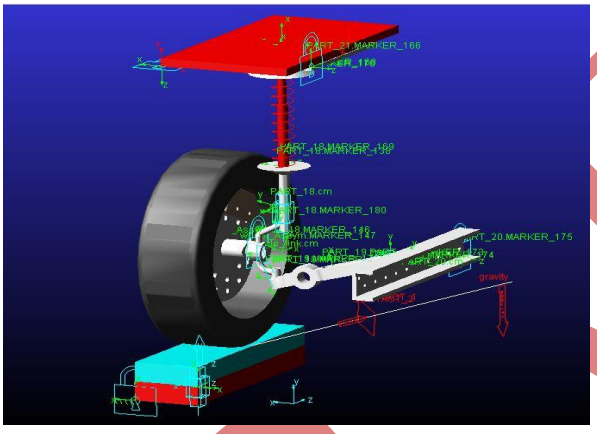

Figure 2 Quarter Model of Existing Suspension System in ADAMS

Figure 2 shows the quarter body suspension system imported in the ADAMS. Suspension system is applied joints and simulation for deflection done on the existing suspension system. Quarter body analysis is done on the existing suspension system, where kerb weight applied on the suspension system for analysis. Figure 3 which is graph for existing suspension system shows that the deformation of the existing suspension system is 83mm.

In Fig 3 graphs plotted for existing system shows the deformation of the existing suspension system when kerb weight applied on it. Graph for time versus deflection is plotted, which shows the deflection with the kerb weight.

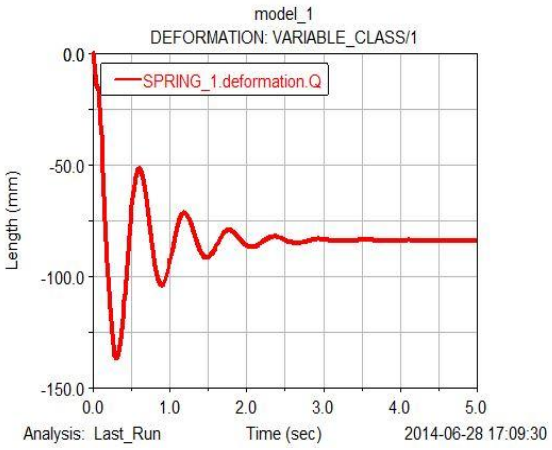

Fig 3 Graph for Existing Suspension System with Kerb Weight

3.2 Analysis Of Modified Suspension System In ADAMS

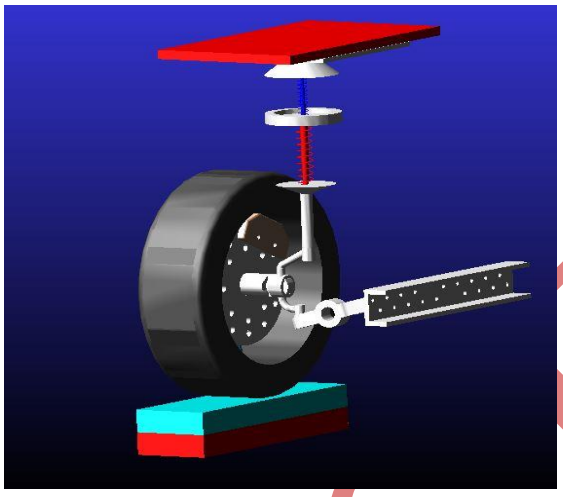

Fig 4 Quarter Model of Modified Suspension System in ADAMS

Figure 4 shows the quarter body of modified series suspension spring in the ADAMS. When kerb weight applied on the suspension system, spring deforms. Deformation of spring is different than the existing suspension system, which is plotted in the figure 4. Graph shows the deformation of the series suspension system with kerb weight.

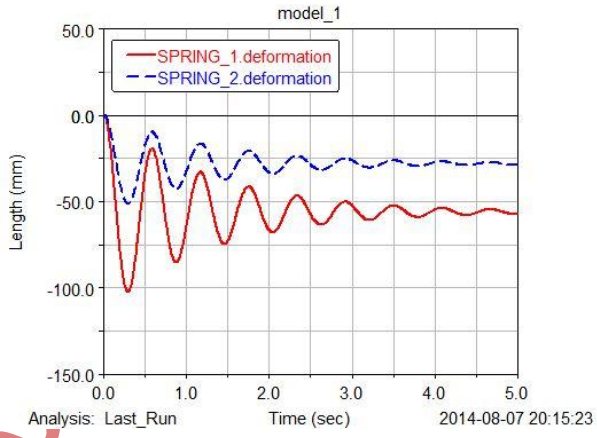

Fig 5 Graph for Series Suspension System with Kerb

In Fig 9 graphs plotted for modified series suspension system shows the deformation of the series suspension system when kerb weight applied on it. From graph and data obtained for deformation is differs, which is caused by changing from one spring to series spring behaviour of suspension get changes. Actual deformation of the suspension spring is shown below. From graph it can be said small irregularities which converted in to the shock is absorbed by lower stiffness spring but when there are high impact load applied at the upward direction higher stiffness spring get activated and it absorb the shocks when higher irregularities of road are there. From graph of deformation versus time it can be seen that total deformation of spring is less than the existing system.

IV. RESULT AND CONCLUSIONS

Suspension system use for comfort ride and to absorb the forces which are transferred in the upward direction. From the graphs we can say that when kerb weight applied deflection of modified suspension system is less than the existing suspension system. It absorbs more irregularities of roads with different springs used together. Spring with lower stiffness absorbs small irregularities and spring with the higher stiffness absorbs high bumps of the road or high irregularities of roads. Hence, modified suspension system is better than the existing suspension system in existing car.

REFERENCES

[1] Paulsen, T.J., Improvements to the Suspension and Modularization of the car Finite Element Model, Thesis, University of Nebraska- Lincoln, April (2003).

[2] Gadhia Utsav D., Prof. Sumant P. Patel, Quarter Model Force Analysis of Wagon-R car's Rear Suspension using ADAMS, International Journal of Engineering Research and Technology ISSN 2278 – 0181 Vol. 1 Issue 5, July (2012)

[3] Gadhia Utsav D., Prof. Sumant P. Patel, Design and Problem Identification of Wagon-R car's rear suspension, International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 2, Issue 7, July (2012), pp 111-113

*[4] Colombo *, M. Gobbi, G. Mastinu, M. Pennati, Analysis of an unusual McPherson suspension failure, Engineering Failure Analysis 16 (2009) 1000–1010*

[5] S.Pathmasharma, J.K.Suresh, P.Viswanathan and R.Subramanian , Analysis of Passenger Car Suspension System Using Adams, International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 5, May (2013)

[6] A.Purushotham, Comparative Simulation studies on Mcpherson Suspension System, International Journal of Modern Engineering Research (IJMER), Vol.3, Issue.3, May-June.(2013) pp-1377-1381

[7] Boesch, D., Front Suspension and Tire Modeling- For Use in Culvert Grate Impact Sinulation, Thesis, University of Nebraska – Lincoln, April 2004.

[8] ROSS, H.E. Jr., Sicking, D. L., Zimmer, R.A., and Michie, J. D, Recommended Procedures for the Safety Performance Evaluation of Highway Features, Report 350, National Cooperative Highway Research Program, Transportation Research Board, Washington, D.C., 1993.